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NOTES ON THE BIOLOGY OF GYNACANTHA NERVOSA RAMBUR (AESCHNINÆ), A CREPUSCULAR DRAGONFLY IN GUATEMALA

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One of the most interesting dragonflies found in Guatemala is *Gynacantha nervosa*, a large somber brownish species (Fig. 1, male) with some green markings particularly at the base of the abdomen and on the back between wings that expand to somewhat more than four inches. Light and airy, with a slender body and wings relatively ample, it is well fitted for a very rapid flight. Appearing mainly towards dusk and at dawn, *Gynacantha* passes the bright hours of the day in some shady wood or in areas under cultivation, among sufficiently dense plant growth, resting alertly head up, its clawed feet gripping some leaf, twig or other support. Sometimes a dull sky will tempt it from its place of concealment earlier than usual, but it is sure to be seen towards sunset a little before the bats and nocturnal insects bestir themselves, remaining on the wing until the fireflies are twinkling in the gathering obscurity. It is seen to less advantage at sunrise.

During one of my earliest sunset walks alongside a small field planted to several varieties of sugar cane, a few of these dragonflies were observed flying low and in a swift undulatory manner over a narrow and then unused irrigation ditch that hugged the edge of the field. Now and then one of these insects would dart upwards and then descend to its "beat", or another would steal between the cane rows, while another still, rising in air, would pursue its rapid wavy course over the cane tops and into the fading sunset. From time to time and with some difficulty a specimen was captured, for purposes of identification, by a scoop of the net from the rear. In my observations extending from April to July, 1934, at El Salto, Escuintla, no other species of crepuscular dragonfly was noted. Other species

of *Æschnine* dragonflies that fly about during the day frequently remain on the wing until dusk when many small insects are flying about. In this subfamily, to quote G. Ting-wei Lew (*Ent. Americana*, XIV, 1933, page 42), "The enlargement of the eyes reaches its maximum development". In the family *Libellulidæ* we find the species of *Neurocordulia* (*Corduliinæ*) of crepuscular habit.

Besides patronizing the edge of the cane field, *Gynacantha* was seen patrolling many other places. Several individuals were observed flying over a stream to which they were most probably attracted by the small mayflies (*Ephemera*) that were rising slowly and steeply from it. Along an open trail some half dozen of these dragonflies were flying back and forth concentrating about an area when a nuptial flight of small ants was taking place. The insect may also fly at some height alongside trees that skirt a wood, and not infrequently appears about verandas if food is there available. Early in the evening of April 24, 1934, several of these dragonflies were flying about the peak and end wall of a building. They were evidently preying upon winged termites that issued in numbers from the wall, seizing these weakly-flying insects and eating them on the wing so that a thin shower of termite wings floated to the ground. A few days later, observations were made on the early morning flight of this dragonfly. May 1, at 5:21 a. m., I saw my first *Gynacantha*, an obscure gray object flying low over the running water of the little ditch alongside the cane field. At 5:35 in the pink dawn, the sun's rays were just striking the three great volcanic peaks of Agua, Fuego and Acatenango. At 5:44 a female *Gynacantha* was flying about as if seeking a place to lay her eggs. Sunrise over the adjoining meadow revealed innumerable little insects, many of which were ants, swarming in the air and from time to time large dragonflies, of which some were apparently *Gynacantha*, zigzagged swiftly among these insects.

By visiting the margin of the cane field, evening after evening, a few *Gynacantha* were observed inserting their eggs in the ditch bank. Several eggs were thus obtained and one dragonfly thereby reared to maturity. A female about to oviposit is very wary, and a note of April 18, will well illustrate this point. At 5:57 p. m. a *Gynacantha* was cautiously inspecting an area along the small waterless ditch that bordered the cane field. She

flew back and forth over this space, hovered with motionless body, darted forward and hovered again. Finally, alighting in the side of the ditch, she curved the abdomen forward and beneath her and applied its extremity to the soil. She remained working thus with outspread wings for less than a minute when, notwithstanding my caution and ample distance, she dashed off. At another date when the ditch contained flowing water, one was observed laying her eggs in soil well above the water line.¹ The

¹Williamson, E. B. (Univ. Mich. Mus. Zool., Misc. Publ. No. 9, 1923) on page 42 mentions the oviposition of *Gynacantha nervosa* in Columbia. Several female *Gynacantha* caught in the field all had their long superior anal appendages broken. This is probably done during oviposition, when these rather delicate processes are pushed against the soil while the slender sword-like ovipositor and the two-pronged fork beyond it are digging the egg cavity. The reared specimen had these superior anal appendages perfect (Fig. 6, A). The egg (Fig. 4) before it is deposited is clear yellow and somewhat finely roughened; when in the ground it may have a somewhat duller finish. It is about 2.25 millimeters long, slightly bent, with one extremity more tapering than the other.

Fletcher, T. B. (Rep. Proc. Fourth Ent. Meet. Pusa, 1921) on pages 270-271 describes the oviposition of *Gynacantha bainbriggei* Fraser in Assam. In the evening he saw several of these insects ovipositing in the bank of a small culvert, the bank being "at most slightly moist" and "It should be added that there was no water in this culvert and there certainly can only be water here when it rains, and the nearest standing water was distant over one hundred yards." Dr. Fletcher's figures of the anal segment of the female *Gynacantha* greatly resemble those of the Guatemalan species and they likewise show the superior appendages broken.

It seems that some other *Æschnine* dragonflies that are day-fliers or crepuscular, approach the manner of oviposition of *Gynacantha*. A note by Dr. Annandale transmitted by F. F. Laidlaw (Rec. Indian Mus., XXII, 1921, pages 88 and 89), referring to the oriental *Æschna ornithocephala* McLachl., reads thus in part: "A number of females were observed ovipositing (in October, after the rains) in a tank of fairly dry earth at the edge of the lake one or two feet above the water level."

Three eggs were located in a bit of soil in which *Gynacantha* was seen working and in all four eggs were found; the three on April 7 and the fourth on April 17. One of these eggs soon decayed; the others were kept in the soil for a time and then immersed with soil, in water. When this material was examined on May 5, a tiny dragonfly larva with a pale cross-like pattern on its head, and apparently in the second stage, was found. This individual, together with a larger one taken from a small pool, were raised to maturity. The larva secured from the egg transformed on June 21 into a nice large female measuring 116 millimeters across outspread wings. Like the more grown field specimen it was relatively quiet in its larval stages, though capable of swift movements, and could squirt a drop or two of water from the apex of its body for a considerable distance in the air. At first it was fed chiefly the larvæ of aquatic diptera, i.e. mosquito wrigglers, but more particularly those of the blood-worm type (*Chironomidæ*); as it increased in size it devoured with avidity tiny fish so numerous in the streams and reservoirs. Not all its moults or instars were noted. What appeared to be the second moult from the prenympchal stage took place by May 9, when it measured nearly six millimeters in length. Its somewhat ashy gray shade was relieved by dark-banded legs and a pale line inwards from each eye that joined at the middle line, was extended along the top of the thorax and was diffused along the abdomen, which, with other parts of the body, was varied by pale and dark marks. The sides of abdominal segments 7-9 were armed with a distinct backward-projecting spine, also represented, though feebly, on segment six. Other moults noted took place on May 20, 24 or 25 and finally the last one on May 31 or June 1. Immediately after each moult the insect is very pallid, but it soon assumes the brownish shade variegated by lighter and paler marks and with the legs dark-banded. In form much like *Anax* but rather more slender, it is a much quieter larva than those of the *Anax* with which I am acquainted. (Fig. 5, final exuvium.) At last it reaches a length of about 40 millimeters. Soon we see indications of approaching emergence in the swollen wing pads and thorax above. It takes no nourishment during the last several days of its larval life and assumes more of a wood-brown shade. About midday June 15, it had

reversed its customary head down position on a submerged twig, its head now being partly out of water. More and more it made use of the large thoracic spiracle for breathing. On later occasions it appeared to have issued quite or nearly out of water, but the time evidently not being ripe for the moult to maturity, it had reversed its position and was again found head down and partly in water. Finally on June 19 it was found entirely out of water, though but a few millimeters above it. As far as I could watch the larva, it maintained this head-down, out of water position for about 24 hours (June 19-20). On the night of June 20 it crawled out to the extremity of the twig and there awaited transformation. When I examined it at 1:43 a. m. the following morning, June 21, it had rather lately emerged, for pale and tender, it clung to the empty shell, its abdomen still a little thick, its wings of glassy silver and as yet held close together over the back. By dawn its silvery wings were in the usual horizontal position and at 6:55 a. m., when I disturbed it, the insect still clung to its exuvium. Thus development from egg to adult required about two and one-half months.

The specimen taken as a partly grown larva in a small pool also grew rapidly under the influence of sufficient food, and its final transformations were observed with more success than in the case of the egg-reared individual. As far as noted, it remained quite out of water in a head-down position for somewhat more than two days. I finally poked it so that it went completely under water but in less than five minutes had reversed its position and crawled upwards so that on my return from dinner an hour later it had gained the extremity of the twig and was hanging from its underside. It went through several movements, including violent twitchings or writhings, as if to free its adult body from the hard larval case. It also "muscle up" with its legs. A swelling at the base of the abdomen beneath became apparent. Shortly after half past twelve a. m. the top of the thorax split, and head and thorax of the adult insect swelled through this enlarging fissure so that it was soon hanging head downwards by the base of the abdomen. A wriggle or jerk of the body now and then and some movement of the folded legs and at last, at about 1 p. m., the emerging insect suddenly bent upwards and grasping the shell at the empty head and thorax pulled its abdomen out of its encasement. An

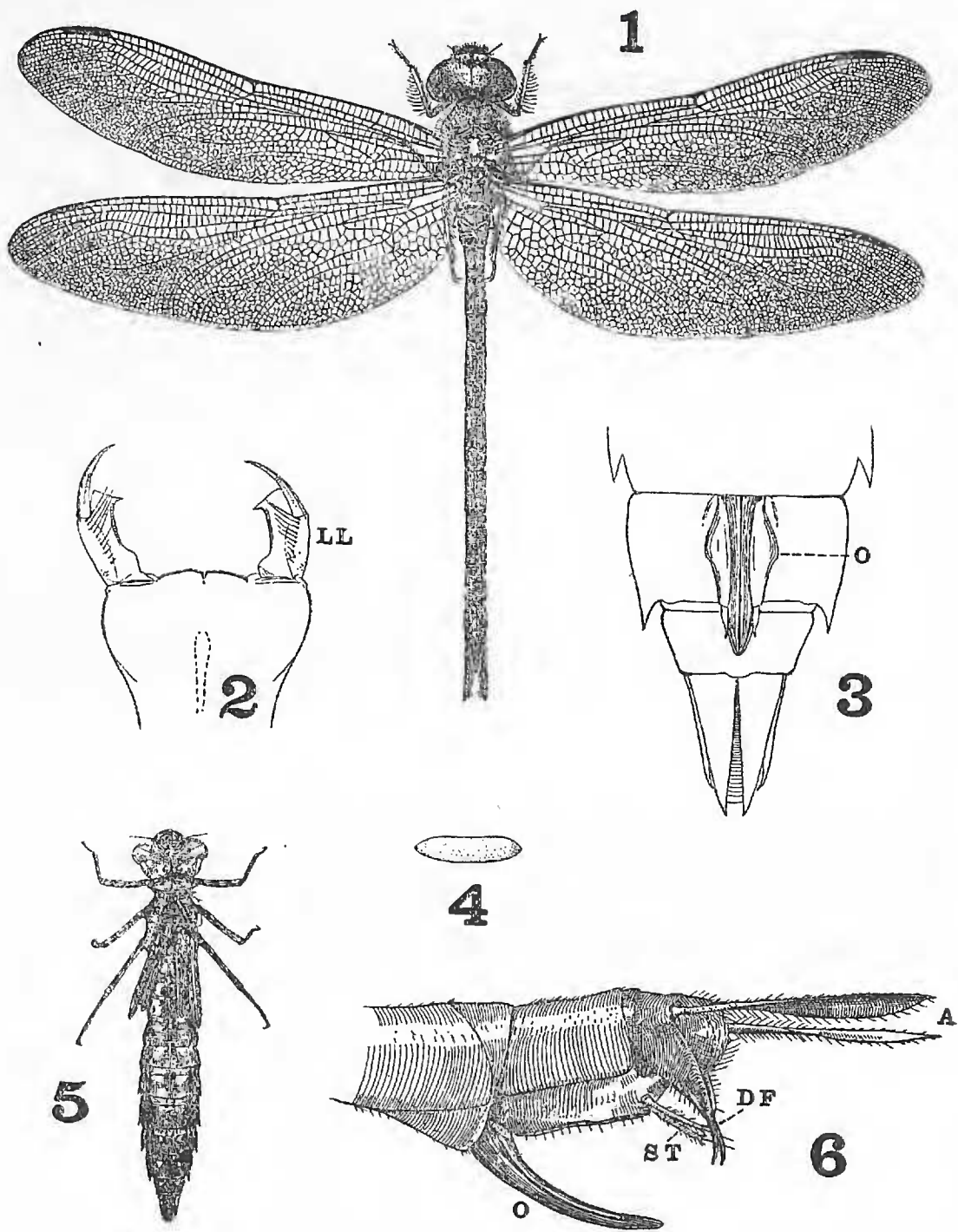
awkward soft creature with stubby wrinkled wings, it developed quickly into the slender graceful insect of the fields. As the wings finally hang down together their full length they are of a dead whitish color; later in the morning they glisten with the beautiful transparency characteristic of such newborn insects. The abdomen lengthens and becomes slenderer, the skin toughens and the dragonfly, still frail and weakly colored, but already fairly proficient on the wing, seeks the early light at the window.

“The genus *Gynacantha* . . . is in some respects the most specialized of all the *Æschnines*; it is so far as I know the only Odonate genus that is definitely crepuscular in its habits”. (Laidlaw, F.F., Proc. U. S. Natl. Mus., 62, Art. 21, 1923, p. 20.)

Williamson, E. B. (1923, p. 41) graphically describes the flight of *Gynacantha nervosa* in the American tropics. He observed how they suddenly filled the air in rapidly coming darkness and as suddenly disappeared twenty or thirty minutes later.

Tillyard, R. J. (London, Jl. Linn. Soc., Zool., 33, 1916, on page 72) writing on *Gynacantha mocsaryi* Förster says: “This species is rarer than the preceding, but occurs not uncommonly in North Queensland, where I have taken it in the dense scrub, in railway tunnels, and also at light. Two specimens were taken by me in the long tunnel No. 15 on the Cairns-Kuranda railway. They were flying slowly up and down, at about noon, and their brilliant green eyes appeared most remarkable in the gloom.”

Lieftinck, M. A., in his “Annotated list of Javan Odonata” (Treubia, XIV, p. 446) has some interesting notes on *Gynacantha subinterrupta* (Ramb.), in part as follows: “The first individuals appear on the wing about half an hour before dusk falls; leave their resting places and commence a rapid skipping flight in the open. About thirty minutes before sundown, at 6:15 p. m. in the wet season, it may commonly be seen hunting for mosquitoes in the darkened verandas of bungalows, in forest-clearings, over roadside brooks, etc. As twilight comes the insects quickly augment to form small flocks and continue their flight in dark situations, e.g. muddy ditches and among pools under the banks of some small stream, where both sexes skim the surface of the ground, stuffing themselves with immense numbers of mosquitoes. In such places, as night has set in for good, they may only be captured by watching for their silhouette.”



GYNACANTHA NERVOSA RAMBUR

“The oviposition was observed by me in wet earth under the over-hanging bank of a shallow pool near Tjisolak (Wijnkoops Bay) in the Karimoen Djaua Islands, where this species is very abundant. I have watched several females ovipositing in the wet soil of a mangrove pool, just before sunset. Few females are taken with the tiny anal appendages whole, these usually having been fractured off during the process of egg-laying, or are gnawed to pieces by the male during copulation. In a forest marsh near the Wijnkoops Bay, I caught two females in the act

of transformation at 10 a. m., the exuviæ hanging on semi-aquatic plants, a few inches above water level. Sometimes, however, the larvæ form burrows or canals in the mud of a ditch or dry-pool, and on emergence ascend a convenient reed stem or stick."

Gynacantha is predominantly a holotropical genus, only a few species extending into temperate regions. In the Pacific it extends well into Polynesia, Fraser describing *G. apiensis* and *G. stevensoni* from Samoa (Insects of Samoa, Part VII, Odonata, pp. 19-44, 5 text figs, 1927).

Gynacantha nervosa is one of our common species being widely distributed in the American tropics and ranging into Florida and California.

I am indebted to Dr. J. G. Needham for determining *Gynacantha nervosa* and for indicating literature referring to it.

NOTE ON IDIOCERUS PROVANCHERI Van D.

In the General Bulletin No. 346, 1920 (p. 19), of the Pennsylvania Department of Agriculture Messers Sanders and DeLong have placed my *Idiocerus provancheri* as a synonym of *Zinneca flavidorsum* A. & S. In 1888 when I began studying the Bythoscopidæ of the eastern United States I made this same erroneous determination and until 1890 this insect stood in my collection as *Zinneca flavidorsum* A. & S. However a careful restudy of the description by Amyot and Serville soon convinced me that their insect had nothing to do with our eastern species. *Zinneca flavidorsum* was described as from "Amerique septentrionale," not from Pennsylvania, and probably was from the West Indies, Mexico or from farther south. The reference to "Pa." in my Catalogue was, I think, taken from Rathvon's list in Mombert's History of Lancaster County, Pennsylvania, published in 1869. Unfortunately I did not have access to this work when I was preparing my Catalogue so that reference was omitted. The head narrower than the pronotum and the entirely coriaceous elytra are sufficient to throw our insect out of *Zinneca* at once. Also the colors given for *flavidorsum* do not apply at all to *provancheri*. Dr. DeLong may have already made this correction but if so I have failed to record it.—E. P. Van Duzee.